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VARIATIONS OF COSMIC RAY INTENSITY IN PASSING  
CYCLONES

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VARIATIONS OF COSMIC RAY INTENSITY IN PASSING

CYCLONES

( Variatsii kosmicheskikh luchey pri prokhozhdenii  
tsiklonov )

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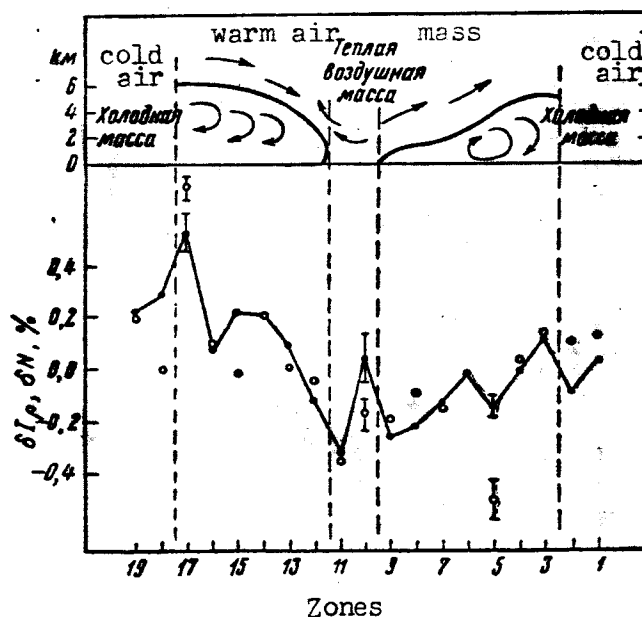
by N. P. Chirkov

The investigation of cosmic ray variations at change of air masses is of interest for the verification of either theories of meteorological effects. Thus, for example, it is shown in [1] , that when cold, warm and occluded fronts pass over the point of observation of cosmic ray intensity variations, the latter have a temperature origin and are explained in a satisfactory manner by the Feynberg-Dorman theory of meteorological effects [2]. It is therefore interesting from that point of view to investigate the variations of cosmic rays at passing of such characteristic process as the cyclone is. The recourse to cyclones is still interesting from another point of view. Having at a given point several installations, sensitive to cosmic rays of various energies, and thus reacting to temperature variations at different altitudes, one may obtain certain data on the meteorological situation in the upper atmosphere layers.

We are considering below the first question: cosmic ray variations at passage of cyclones. The results are compared with computations,

carried out on the basis of the Feynberg-Dorman theory of meteorological effects [2]. Seven cases of passage in Moscow of young cyclones in 1952—1953 are brought out for the investigation. Temperature profiles of the atmosphere and the frontal situation at time of their passage were analyzed by specialists of the Central Institute of Forecasts.

A young cyclone is characterized by a non-uniform temperature distribution [3]. The well-expressed warm quadrant is limited by a warm front line in the forward part of cyclone, and by a cold front in its rear part.



The processing of material consisted in the following: The total period marking the passage of the cyclone was divided in 19 zones. Temperature deflections from the average were found for each zone at the level corresponding to the investigated period, using standard isobaric levels (see Figure). The obtained temperature variation epochs have been averaged for the seven cases by the superimposition method.

The hourly values of the global intensity of cosmic rays  $\delta I_p$  (hard component), corrected for the barometric pressure at Moscow st., were processed by a similar method. The value  $\delta I_p$  was taken for the hour following the radiosonde outlet. The mean variations of  $\delta I_p$  at passage of the seven cyclones are shown by solid lines. In the upper part of the graph the vertical profile of a young cyclone may be seen [3]. The figure shows that the intensity of cosmic rays drops by 0.3 to 0.4 percent at the passage of the warm front (forward part of the cyclone), reaching a minimum ahead of the cold front, then increasing by 0.7—0.8 percent.

The theoretical course of intensity  $\delta N$  was computed by the available temperature profile of the atmosphere.

The results are indicated by clear circles. As may be seen from that Figure, a good agreement is observed between the theoretical and experimental data (correlation coefficient between them being 0.79).

The divergence in certain zones is basically explained by the fact that the contribution of higher-lying atmosphere layers was not taken into account (there were few radiosonde raisings above 200 mb). The greatest divergence between  $\delta I_p$  and  $\delta N$  is of the order of 0.2—0.3%. Using the density of the temperature coefficient for the 0—150 mb layer (0.064% per  $1^\circ$ ) [2], we obtain that inverse troposphere temperature variations of the order of 3 —  $4^\circ$  must exist in the stratosphere. This does not contradict the representations developed by L. R. Rakipova about alternating circulation processes in the atmosphere.

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